UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/727,679	12/04/2003	Henry P. Moreton	NVDA P000502	8479

26291 7590 02/28/2006

PATTERSON & SHERIDAN L.L.P.
595 SHREWSBURY AVE, STE 100
FIRST FLOOR
SHREWSBURY, NJ 07702

EXAMINER	
PRENDERGAST, ROBERTA D	

ART UNIT	PAPER NUMBER
2671	

DATE MAILED: 02/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/727,679	MORETON ET AL.	
	Examiner	Art Unit	
	Roberta Prendergast	2671	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-12,15,16,18 and 20-25* is/are rejected.

7)☒ Claim(s) *2,3,13,14,17 and 19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 December 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/27/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: page 14, paragraph [0038] discloses that "...Fig. 4B edge 80 equals e<0,5>, and in Fig. 4C edge 80 equals e<1,0>..." however, edge 80 equals e<1, 0> in both Figs. 4B and 4C in the drawings. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-8, 12, 15, 16, and 20-25 are rejected under 35 U.S.C. 102(b) as being anticipated by Huang et al. U.S. Patent No. 6825839.

Referring to claim 1, Huang et al. teaches a method for indexing vertex data defining at least one primitive, comprising assigning a unique reference to each vertex defining the at least one primitive, identifying one-ring neighbor vertices of each vertex, assigning the unique reference of each vertex to each of the one-ring neighbor vertices of each vertex, and assigning a unique neighbor index to each of the one of the one-ring neighbor vertices of each vertex (Figs. 3, 4 and 10; column 2, lines 44-63; column 4, lines 35-49 and 61-66; column 5, lines 3-12, i.e. each vertex of a triangle mesh is given a unique index position in a two dimensional array and each one-ring neighbor of each vertex is given a unique neighbor index position in an array located at that unique index position for example, for vertex 1 neighbor 1 has an index of <1,1> and neighbor 2 has an index of <1, 2> in the two dimensional array).

Referring to claim 2, the rationale for claim 1 is incorporated herein, Huang et al. teaches the method of claim 1, wherein a unique neighbor index includes an offset (Fig. 4; i.e. each one-ring neighbor is given a unique neighbor index position in an array located at that unique index position with the first unique neighbor index position being offset by zero and each subsequent unique neighbor index position is offset by 1).

Referring to claim 3, Huang et al. teaches the method of claim 1, wherein the offset is used to specify a consistent order of calculation for use during primitive processing (Fig. 4; i.e. each one-ring neighbor is processed in ascending order from the first position in the array until the last position).

Referring to claim 4, Huang et al. teaches the method of claim 1, wherein the at least one primitive is a polygonal primitive (Fig. 4 and 6; column 3, lines 60-65, i.e. triangles are polygons).

Referring to claim 5, Huang et al. teaches the method of claim 1, wherein the at least one primitive is a quadrilateral primitive (Fig. 4 and 6; i.e. a quadrilateral primitive is represented by vertices 1, 2, 3, and 4 with vertex 1 having neighbors 2, 3, and 4).

Referring to claim 6, Huang et al. teaches the method of claim 4, wherein the polygonal primitive is a triangular primitive (Fig. 4 and 6; column 3, lines 60-65).

Referring to claim 7, Huang et al. teaches the method of claim 1, wherein the at least one primitive is a point primitive (Fig. 4; column 3, lines 60-65, i.e. vertices represent points).

Referring to claim 8, Huang et al. teaches the method of claim 1, wherein the at least one primitive is a line primitive (Fig. 4 and 6; column 3, lines 60-65, i.e. a line primitive is represented by vertices 2, 4, and 5 with vertex 4 having neighbors 2 and 5).

Referring to claim 12, Huang et al. teaches the method of claim 1, further comprising identifying an edge between a first vertex and a second vertex, the second vertex being a one-ring neighbor of the first vertex (Fig. 4; column 5, lines 13-35, i.e. each vertex of each edge in the Incident Edge Table is a one-ring neighbor of the other, for example, for edge (v_0, v_1) vertex v_0 is a one-ring neighbor of vertex v_1 and vertex v_1 is a one-ring neighbor of vertex v_0 since there are no other vertices located between them).

Referring to claim 15 Huang et al. teaches the elements of claim 1 and further teaches successively incrementing the neighbor index to provide incremented neighbor indices for assignment to the one-ring neighbor vertices remaining and sequentially assigning one of the incremented neighbor indices to each of the one-ring neighbor vertices remaining (Figs. 3, 4 and 10; column 2, lines 44-63; column 4, lines 35-49 and 61-66; column 5, lines 3-12, i.e. assigning each of the neighbors to a neighbor index position in the two dimensional array is done sequentially at incremented positions).

Referring to claim 16, Huang et al. teaches the method of claim 15, wherein the sequentially assigning is done according to an ordering of the one-ring neighbor vertices (Fig. 4; i.e each vertex is numbered incrementally as it is added to the vertex table and then it is inserted into the next available index position a_{next} of the two dimensional array and then entered into the next available neighbor index position a_{ij} for all vertices a_i of which it is a neighbor and then a neighbor array at index position a_{next} is created and all vertices a_i are added at the next available neighbor index position a_{nextj}).

Referring to claim 20, Huang et al. teaches the method of claim 15, wherein the vertex and at least a portion of the one-ring neighbors define a primitive (Fig. 4, i.e. vertex 1 and its one-ring neighbors 2 and 4 define triangle 0).

Referring to claim 21, Huang et al. teaches the method of claim 15, further comprising assigning a second reference to one of the one-ring neighbor vertices to define a second reference vertex, identifying one-ring neighbor vertices of the second reference vertex, the one-ring neighbor vertices including the first reference vertex, assigning the second reference to each of the one-ring neighbor vertices of the second

reference vertex identified, assigning an additional neighbor index to one of the one-ring neighbor vertices of the second reference vertex identified (Fig. 4, vertex 2 is a one-ring neighbor of vertex 1 which is given a unique index position in a two dimensional array and each one-ring neighbor of vertex 2, including the first reference vertex, vertex 1, is given a unique neighbor index position in the neighbor array located at that unique index position for example, for vertex 2 neighbor 1 has an index of <2,1> and neighbor 2, which is vertex 4, has an index of <2, 2> in the two dimensional array), successively incrementing the additional neighbor index to provide incremented additional neighbor indices for assignment to the one-ring neighbor vertices of the second reference vertex, and sequentially assigning one of the incremented additional neighbor indices to each of the one-ring neighbor vertices of the second reference vertex remaining (Figs. 3, 4 and 10; column 2, lines 44-63; column 4, lines 35-49 and 61-66; column 5, lines 3-12, i.e. assigning each of the neighbors to a neighbor index position in the two dimensional array is done sequentially at incremented positions).

Referring to claim 22, Huang et al. teaches the method of claim 21, wherein the first reference vertex may be referenced using the first reference or using the second reference at an additional neighbor index assigned (Fig. 4, i.e. it is understood that vertex 1 can be referenced from the two-dimensional array VNB at VNB<2, 1>, VNB<3, 1>, or VNB<4, 1> or from the vertex table VT using VT<1>).

Referring to claim 23, Huang et al. teaches the method of claim 22, wherein data corresponding to the first reference vertex is stored in a portion of memory accessed

using the first reference (column 4, lines 43-49; column 5, lines 3-12, i.e. vertex 1 is stored in the vertex table VT and is accessed using its index VT<1>).

Referring to claim 24, Huang et al. teaches the method of claim 23, wherein data corresponding to the first reference vertex stored in the portion of memory is accessed using the second reference and the additional neighbor index assigned (column 4, lines 43-49; column 5, lines 3-12, i.e. vertex 1 is stored in the two-dimensional array VNB and is accessed using the second reference and the additional neighbor index assigned VNB<2, 1>).

Referring to claim 25, Huang et al. teaches the method of claim 21, wherein the second reference vertex may be referenced using the first reference and a neighbor index assigned or using the second reference (column 4, lines 43-49; column 5, lines 3-12, i.e. vertex 2 is stored in the vertex table VT and can be accessed either from the two-dimensional array VNB using the first reference and the additional neighbor index assigned VNB<2, 1> or by using the second reference VT<2>).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 9-11 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al. U.S. Patent No. 6825839 as applied to claims 1 and 4 above, and further in view of Li et al. U.S. Patent No. 6262737.

Referring to claim 9, Huang et al. teaches the method of claim 1 wherein the indexing is related to three-dimensional computer graphics (column 1, lines 20-35) but does not specifically teach wherein the at least one primitive defines a volume.

Li et al. teaches wherein the at least one primitive defines a volume (Figs. 7(a and b) and 9; column 13, lines 15-22, i.e. a tetrahedron is a primitive that defines a volume).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Huang et al. to include wherein the at least one primitive defines a volume thereby providing a simple base mesh that can be coded as a regular mesh with only a few bits (column 13, lines 19-22).

Referring to claim 10, Huang et al. teaches the method of claim 9 but does not specifically teach wherein the at least one primitive is a tetrahedron.

Li et al. teaches wherein the at least one primitive is a tetrahedron (Figs. 7(a and b) and 9; column 13, lines 15-22).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Huang et al. to include wherein the at least one primitive is a tetrahedron thereby providing a simple base mesh that can be coded as a regular mesh with only a few bits (column 13, lines 19-22).

Referring to claim 11, Huang et al. teaches the method of claim 9 but does not specifically teach wherein the at least one primitive is a cube.

Li et al. teaches wherein the at least one primitive is a cube (Figs. 7(a and b) and 9; column 14, lines 48-60, i.e. rectangular patches are used to represent smooth surfaces and a 3d base mesh would be cubical in the areas comprised of rectangular patches).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Huang et al. to include wherein the at least one primitive is a cube thereby providing a simple base mesh that can be coded as a regular mesh with only a few bits (column 13, lines 19-22).

Referring to claim 18, Huang et al. teaches the method of claim 15 but does not specifically teach totaling the one-ring neighbor vertices sharing an edge with the vertex to provide a total and indicating the total as a valence of the vertex.

Li et al. teaches totaling the one-ring neighbor vertices sharing an edge with the vertex to provide a total and indicating the total as a valence of the vertex (Figs. 8(a and b), i.e. in 8a the two vertices have a valence of 5 and collapsing the edge connecting these two vertices gives a new vertex with a valence of 6; column 13, lines 18-19, i.e. a valence n gives the total number of neighboring vertices).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of Huang et al. to include totaling the one-ring neighbor vertices sharing an edge with the vertex to provide a total and indicating the total as a valence of the vertex thereby providing connectivity information

such as the number of neighboring vertices and the number of edges connecting vertex to its neighbors for a simple base mesh that can be coded as a regular mesh with only a few bits (column 13, lines 19-22).

Allowable Subject Matter

Claims 13, 14, 17, and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Referring to claims 13 and 14, cited prior art teaches the method of claim 12 but does not teach assigning the unique reference of the first vertex to the edge and assigning the unique neighbor index of the second vertex to the edge and further does not teach assigning the unique reference of the second vertex to the edge; and assigning the unique neighbor index of the first vertex to the edge.

Referring to claim 17, cited prior art teaches the method of claim 15 but does not teach wherein the ordering of the one- ring neighbor vedices is user determined.

Referring to claim 19, cited prior art teaches the method of claim 15 but does not teach wherein the unique neighbor index includes an offset as defined in the specification.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following patents and are cited to further show the state of the art with respect to indexing vertices and their neighbors.

Taubin U. S. Patent No. 5506947

Morgan et al. U. S. Patent No. 5821940

Migdal et al. U. S. Patent No. 5886702

Van Beek et al. U. S. Patent No. 6047088

Lee U. S. Patent No. 6307555

Johnson et al. U. S. Patent No. 6362823

Stam U. S. Patent No. 6389154

Gueziec et al. U. S. Patent No. 6452596

Lounsbery U. S. Patent No. 6553337

Moreton et al. U. S. Patent No. 6738062

Cirak et al. U. S. Patent No. 6876956

Schroeder et al. U. S. Patent No. 6995761

Desbrun et al. U. S. Patent Application No. 2003/0011589

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberta Prendergast whose telephone number is (571) 272-7647. The examiner can normally be reached on M-F 7:00-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571) 272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

RP

ULKA CHAUHAN
SUPERVISORY PATENT EXAMINER